Measuring Magnetic Properties of Thin Films using the longitudinal Magneto-Optic Kerr Effect (MOKE)

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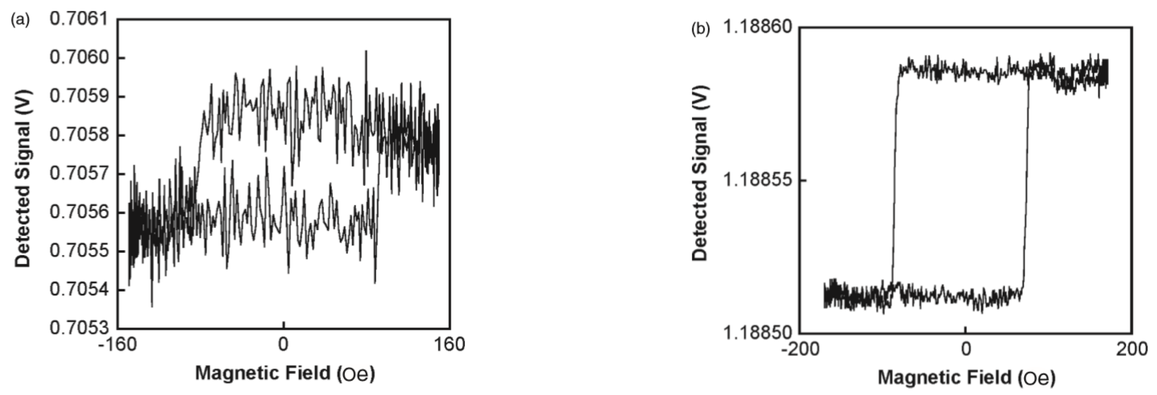
Motivation

When working with thin films on the order of nanometers thick, testing magnetic properties through electromagnetic induction is impractical. Dr. Paul Crowell's research group explores promising applications of such thin films of Heusler alloys for use in electronic devices. Using reflected light, the longitudinal MOKE can instead be used to produce hysteresis loops for thin film Heusler alloys in order to measure their magnetic properties.

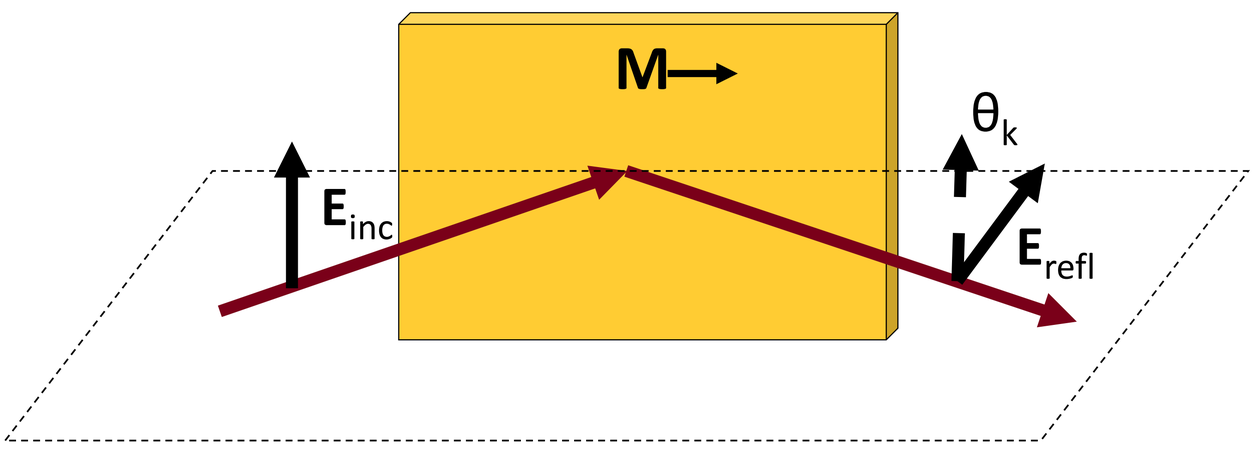
Hysteresis Loops



Two examples of hysteresis loops from Allwood et. al. are shown. Loop (a) is obscured by noise, but both show nearly rectangular loops. Deviations from a rectangular loop reveal anisotropies of the sample.

Longitudinal MOKE

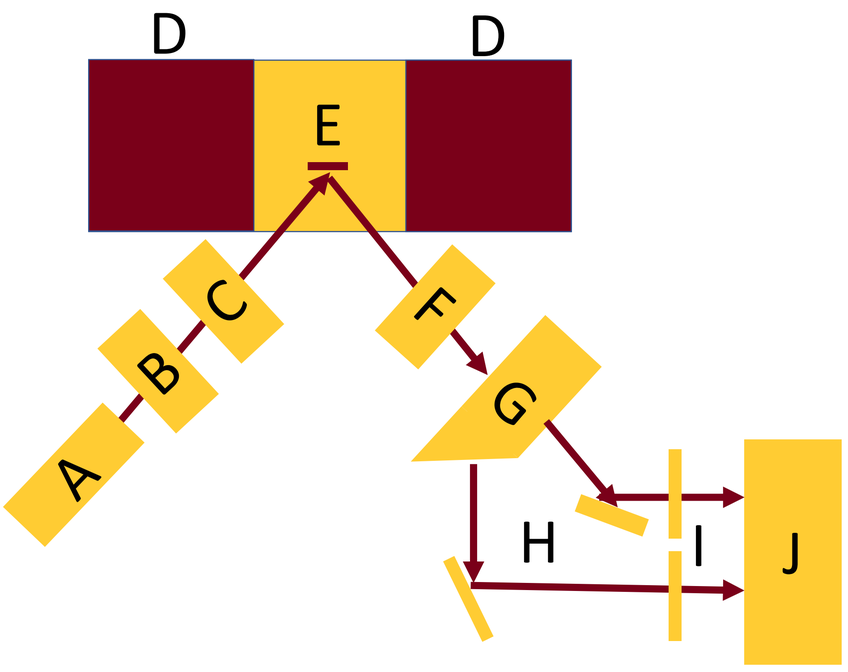
Longitudinal MOKE Occurs when s-polarized light is reflected off a magnetic material. The electric field component is rotated in the direction of magnetization



Further Work

The apparatus shown is fully assembled. It will be controlled using LabView programming. The code to control the electromagnet has been written and the code to control the optical chopper and read out the photodiode is in progress. Once completed, the apparatus will be tested on Permalloy samples before moving on to Heusler alloys. The samples will be rotated around the axis of reflection and hysteresis loops will be produced.

Apparatus



A. Laser
B. Polarizer
C. Chopper
D. Electromagnet
E. Thin Film Sample
F. Half Waveplate
G. Glan-Thompson Prism
H. Mirrors
I. Converging Lenses
J. Photodiode

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